Responsible Technology: A Brief Review of the Possibility

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Introduction

Technology is intertwined and enmeshed with the daily lives of people in modern society. It is omnipresent, and seemingly omniscient. It is such a basic part of the existence of most people that it is taken for granted. "As a result, modern technology and all it entails are often accepted by default, with few questioning what life would be like if humankind performed tasks and attained goals by other means." (Monsma et al., 1986, pg. 1) Through the use of ideas and statements such as these, the authors of Responsible Technology: A Christian Perspective have attempted to begin to address the philosophical underpinnings of technological development, and to some extent, the related concepts of scientific thought. The book is a call for the reevaluation of the nature and role of technology and science in modern society, and by extension, in educational practice. The authors present a case for basing the nature and roles of technology on the "normative principles" of cultural appropriateness, openness and communication, stewardship, delightful harmony, justice, caring and trust. This paper is an attempt to evaluate this call for reform in light of its appropriateness for society as a whole. Implications of the proposed changes, to education and to curriculum development specifically, will also be briefly explored.

While the ideas outlined in the book reviewed here are definitively expressed from a religious view point, it is important to note that they may have validity from other perspectives as well. Some of these other positions would include environmental, philosophical, and anthropological stands. I agree with the authors that understanding and appreciating technology in an appropriate way is fundamental to life and consequently to education. I do not believe that society has adequately addressed these issues or has distorted the nature and roles of technology and science to such an extent that these constructs may have become more detrimental than constructive. On the basis of this conviction, I believe that curricula must address these issues and educational practices must change in the hope of eventually modifying societal understandings. I share the thoughts of Paulo Freire when he says that "to exist, humanly, is to name the world, to change it" and "to say the true word ... is to transform the world." (Freire, 19 , pg. 76)

Definitions of technology

Technology can be viewed from many different perspectives. Monsma et al. (1986) outline at least four different sets of definitions for technology. A great deal of confusion is evident in these definitions due to the different foci and emphases which are prevalent in each. While the definitions are fundamentally different, there are some commonalities. Each explanation includes an acknowledgement of technology as a set of procedures and/or products that rely directly or indirectly on scientific investigations or knowledge. Technology then becomes a praxis as well as a body of knowledge. The authors of this book feel that each of these approaches has a certain amount of validity, however there are fundamental flaws in each one. The definitions are reviewed briefly in order to pick at their weaknesses and then an alternative is given that, in the minds of the authors,

"incorporates the strengths of the three commonly used approaches to defining technology but avoids their weaknesses. (Monsma et al., 1986, pg. 17)

The first definition that Monsma et al. deal with is the anthropological approach. According to the authors, this approach characterizes technology as an activity that humans carry out. Technology, in this definition, is a an offshoot of human nature and is intrinsically bound up with the nature of humans. Melvin Kransberg and Carroll W. Pursell, Jr., as examples of people who hold this position, are quoted as defining technology as "nothing more than the area of interaction between ourselves, as individuals, and our environment, whether material; or spiritual, natural or man-made." (Monsma et al., 1986, pg. 13) This type of characterization, which while it identifies technology as a human activity does not carry with it any responsibilities to other humans, the environment or anything else. Technology, according to this approach, is an example of anthropocentric thought and practice.

Another way in which to define technology might be termed the "epistemological approach." (Monsma et. al., 1986, pg. 14) This approach views technology as a specialized body of knowledge. This knowledge is usually derived from but is still separate from scientific principles, as viewed by philosophers of science. Engineers would feel that technology is knowledge that is required to produce tools and products. Social scientists would feel that this knowledge is of importance because of its consequences on society. This approach can be illustrated in the definition given by Bernard Gendron (as quoted in Monsma et al., 1986, pg. 15) when he says that technology is "any systematized practical knowledge, based on experimentation and/or scientific theory, which enhances the capacity of society to produce goods and services, and which is embodied in productive skills, organization, or machinery." The main problem with this type of approach, according to Monsma et al., is that, in viewing technology as a body of knowledge, the values regarding the purposes of the technology are not included. This approach results in a denial of the relationship of people to each other and to their environment. Technology is a special type of knowledge, but what is it's purpose and how should it be used? This issue is not addressed to the satisfaction of the authors of this book.

A third approach that can be used to define technology is viewed by Monsma et al. as a sociological approach. Those who hold this position "see modern society as being technologically conditioned and molded - some would even say determined. They believe that the defining characteristic of technology is its pervasive, dominating influence in society." (Monsma et al., 1986, pg. 16) The major shortfall of this view, according to the authors is that, while this approach focusses on the values and attitudes that result in society due to the permeation of technology into the basic structures of society, it does not concentrate on what technology is. More importantly, this view does not give any direction regarding how to "evaluate and judge (technology's) impact, how to gain insight into the reasons behind it, and how to alter it." (Monsma et al., 1986, pg. 17)

Implications of Confused Definitions of Technology

Before continuing on to share the definition of technology developed by Monsma et al., it may be wise to ascertain the implications of the commonly held definitions of technology discussed above on society as a whole. Monsma and his associates devote a large portion of their book to this purpose. These implications are viewed from several perspectives: the neutrality of technology (science), the rise of technical secularism (technicism), the links of technology to economics, and the links of technology to the state. Each of these perspectives will be briefly reviewed here.

Many people in today's society believe that technology, and indeed science, are value neutral. This is essentially the same argument that is used when people imply that science and technology are

also objective and functional. (Knight, 1980, Field, 1985) While much of the general public, students and a few science teachers may believe these ideas, philosophers of science and many practitioners have long since given up these concepts. For instance, Robin Millar and Rosalind Driver (Millar and Driver, 1987) cite Hanson, Kuhn, Gregory and Chalmers when they state that "it is now widely (if not consensually) held within philosophy of science that all observation is theory-dependent, that what we see is dependent to some extent on the theories which we hold." Monsma et al. react to the concepts of the supposed neutrality of science and technology. The authors state that valuing is at the heart of technology since the presence of human will is intertwined in doing technology. They go on to state that this valuing should not be denied and should in fact be recognized and based on the principles that they present in their own definition of technology.

Using a historical setting, the authors of Responsible Technology outline the development of technical secularism. Essentially, they feel that modern philosophy has continued the development of ideas that were established centuries ago. These ideas centre on human mastery over the environment and the autonomy of humans from any spiritual (and to a large extent environmental) responsibility to higher powers. Many examples are cited from the Renaissance and the Enlightenment periods of history. The work of Francis Bacon, Isaac Newton, René Descartes, John Locke and Adam Smith are used to show how thought (and the subsequent actions) were freed from the need for divine intervention and guidance which was so evident in the Middle Ages. The result of this thought development can be seen, according to Monsma et al., in modern Western culture. "The powerful line of secularization ... has as its reigning characteristic the belief in human autonomy and power. Humankind has put itself at the centre of all things and declares that it will find progress and life - its own salvation - by taking its destiny into its hands and bending history to its will." (Monsma et al., 1986, pg. 49) This drive for autonomy is termed technicism by the authors. An understanding of the implications of technicism can be gleaned from the following passage:

> "Technicism reduces all things to the technological; it sees technology as the solution to all human problems and needs. Technology is a saviour, the means to make progress and gain mastery over modern, secularized cultural desires. Technology thus becomes its own reason for existing. This 'technology for technology's sake' is the ultimate form of technicism. More specifically, technicism is marked by three key characteristics or beliefs: (I) technological change - the development of ever more complex, ever more sophisticated technological objects - is inevitable: (2) such change represents progress, leads to improved conditions for humankind; and (3) there are technological solutions to the problems engendered by technological change. Technicism says that humankind can use its hands and minds - it technology - to build a kingdom of plenty, ease and peace. Thus if something can be done, it should be done - no questions asked. 'You can't stop progress!'"
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> (Monsma, et al., 1986, pg. 49-50)

Again the definition of technology is brought into question. In addition it becomes very evident that a standard against which the claims of technology can be measured is needed.

The relationship between economics and technology also deserves some attention. According to Monsma et al. (1986, pg. 103), economics has historically been viewed as "having to do with the transformation of resources into desired forms for the benefit of consumers, under conditions of scarcity. Technology is then seen as the means by which this transformation is accomplished. The

criterion for evaluating this transformation - and thus the criterion for evaluating technology - is efficiency." When these concepts are combined with those of technicism, the role of valuing becomes preeminent. Who is to determine what resources should be used? On what basis will decisions regarding the use of those resources be made? What of the technologies that are needed to develop the resources - how can they be valued as to whether their use is appropriate? These are some of the questions that can not be answered satisfactorily unless there is an adequate definition of technology available and the basis for the needed judgements is determined.

One final area of interaction that is explored by Monsma and his colleagues is that found between technology and government. The authors suggest that big, modern government, as well as technology, plays an important role in all modern societies. The interaction of these two is inevitable. The interaction is generated by investigating the role of government and then applying that role to technology. It is stated that "the state rules by making decisions for a society that have the weight of authority: the appropriateness or moral necessity of obedience underlies its decisions and its power - its ability to compel obedience and to punish those who fail to obey - backs them up." (Monsma et al. 1986, pg. 144) This definition is pushed further when the authors add that Christians believe that government is established by God and its ultimate purpose is to "promote justice." These principles are violated by a technology that takes no regard of the environment, is developed because it can be developed and serves only the purpose of increasing profit for the corporation or individual responsible for its production. It is the role of government to use its "power, rule, and authority to guide technology back onto paths of justice. However if the state does not have an inviable standard upon which to make judgements of the appropriateness of a technology then justice cannot be served. Technology is left to its own devices and it becomes oppressive.

Technology in Education

The nature and role of technology is pervasive in modern society. Its influence is not only evident in the general structures of society but also in smaller sectors. The next section of this paper will examine the role of technology in education, particularly as it is conceived of in Ontario. The purpose is to determine how closely the theoretical material discussed earlier fits with educational thought as it exists presently.

Technology has become an important part of educational thought. The Common Curriculum (Ontario Ministry of Education and Training, 1995, pg. 70) suggests that technology education should be integrated into the curriculum so that students can "see the many connections between mathematics, science and technology, particularly as they are applied in everyday life." Specifically, according to the Common Curriculum (pg. 71), technological education should allow students to develop skills in a number of areas including, problem solving, design, fabrication, and the use of tools. In addition, students are required to understand agricultural and manufacturing systems and evaluate their impact upon society and upon the environment. While these ideas are well intentioned, there is a basic lack of definition about the nature of technology and how it should be studied as well as practiced.

The type of language used in this document yields clues as to the intent of the authors. The terminology includes words and phrases such as: use technology, evaluate the influence of technology, safety, ethics, aesthetics, efficiency and efficacy. (Ontario Ministry of Education and Training, 1995, pg. 77, 76) The use of this type of terminology shows the philosophical stance that is underlying the proposals. This philosophy seems to assume that technology is neutral in terms of ethical values and that technology (and science which lies at its heart) becomes the solution to all

human problems. Thus students who can access the technology appropriately will be able to solve problems and do so efficiently and effectively.

The curriculum document which preceded the Common Curriculum, Ontario Schools, Intermediate and Senior Divisions (Grades 7-12/OACs): Program and Diploma Requirements (OS:IS), was less committal in its references to technology. Perhaps this was due to a more fundamental reliance by the authors on the technicist view point. The OS:IS document (Ontario Ministry of Education, 1987, pg. 11), in its Aims of the Science Curriculum, that students "are expected to achieve a degree of scientific literacy, which will allow them to adapt to technological changes" and that "students are to realize that many benefits of science are derived through technology' Technology is not substantially separated from science, in this document, except for a statement that denotes technology as "the application of scientific knowledge and principles." (Ontario Ministry of Education, 1987, pg. 11). The definitions of science (taken as somewhat synonymous with technology) included in the document clearly show this viewpoint. Among other characteristics, scientific (and technological) knowledge is seen as being tentative, which is open-ended and not final, empirical, integrative, and imperative. To the credit of the authors of this work, it is acknowledged that science is a human construct. However this aspect is used to enhance the characteristic of the subjectivity of science not its impact on culture or on its interactions with other aspects of life. The authors also acknowledge that scientific knowledge is limited to the study of nature, which is "basically . . . matter and energy." (Ontario Ministry of Education, 1987, pg. 13) It is also stated that "society must resolve issues by reaching value decisions based on scientific, economic, political, societal, and moral factors." How these decisions are to be made and on what basis is not addressed.

An Alternative View

The foregoing paints a fairly bleak picture, however Monsma et al. do offer an alternative definition to the nature and role of technology. Their alternative definition is stated as "a distinct human cultural activity in which human beings exercise freedom and responsibility in response to God by forming and transforming the natural creation, with the aid of tools and procedures, for practical ends or purposes." (Monsma et al., 1986, pg. 19) In this definition Monsma and his colleagues have included many of the characteristics of the three approaches previously discussed. Technology is taken to be an activity that is performed by humans in the context of a culture. The responsibilities of doing technology are not assumed in this definition. They are purposefully included as is the object to whom accountability is due. It is not just to humans that doers of technology are to be accountable, it is to God. This can be taken as a broadening of the traditional view as discussed in the sections regarding the interactions of technology and economics, as well as the interactions with the state. It also gives rise to a number of principles upon which technology and technological design can be judged. These principles will be discussed in the following section of this paper.

The section of the definition which deals with the transforming of nature is used to distinguish technology from other types of human activities. This portion deals with making products out of existing materials or changing these materials from one form to another. The authors state that these activities involve two separate processes: design and fabrication, that is planning process and the carrying out of the plans. The section of the definition which specifies that technology is done with the aid of tools and procedures acknowledges that technology is done using materials that have been themselves designed and wrought. This section also states that technology is done while following pre-specified procedures, that is, using specific knowledge in specific ways. The final part of the

definition suggests that technology is done to provide products and procedures which have practical uses.

The foregoing definition of technology assumes the existence of a set of principles upon which judgements regarding the appropriateness of technology and technological activity can be made. The authors of the book Responsible Technology provide such a set of principles. They are given in the context of principles upon which design procedures and the design of a technological object itself can be measured. They term these principles "normative principles." and they suggest that they are should be part of a holistic approach to design. The principles are: cultural appropriateness, openness and communication, stewardship, delightful harmony, justice, caring, and trust. (Monsma et al., 1986, pg. 71-76)

While many of these "normative principles" may be self-evident as to their meaning, it would be prudent to spend some time to consider them from the perspective of the authors of the book under consideration. According to the authors, "cultural appropriateness is achieved by making appropriate decisions regarding five sets of opposites: continuity and discontinuity, differentiation and integration, centralization and decentralization, uniformity and pluriformity, and large scale and small scale." (Monsma et al., 1986, pg. 71) The authors go on to state that there are no clear easy ways to make decisions regarding any of these opposites but they must be kept in mind along with the rest of the normative principles while pursuing technology. The overriding sense given here is that technology must be done with the good of the culture which is involved at heart.

The authors state that for technological activities to progress in appropriate ways there must be a constant attempt to transmit information. There needs to be an openness to the views of others as well as constant attempts to communicate between those developing technology as well as those for whom the technology is intended. The primary rationale here is accountability. Without openness and communication it is impossible for accountability to exist.

Technology must be carried out in a stewardly fashion. Stewardship requires that both material and human resources must be respected. This principle carries much of the responsibility that technology is to shoulder with regards to the environment and to human labour. The principle of delightful harmony emphasizes the aspects of technology dealing with aesthetics and ergonomics. Technological products "should be a joy and a delight because they work properly and are satisfying to use, and because they have a beauty of line and form." (Monsma et al., 1986, pg. 73)

Justice should be persued in the doing of technology, according to the authors. This principle would involve according societies, cultures, human beings, and the natural creation what is due to them and it should attempt to shield these from other elements in nature. Technology should also reflect a caring for others. The authors state that "in doing technology we are to act as servants, to love and care for - to safeguard the well-being of - our neighbours, near and far, and the natural creation." (Monsma et al., 1986, pg. 74-75)

Finally, doing technology, according to Monsma and his colleagues, must ultimately involve trust. This trust that the authors speak of has two aspects. First, technological products and procedures must be trust-worthy, that is, dependable. They must be as advertized both in function and in looks. They must also be safe within reasonable bounds. The second aspect of trust, for the authors, deals with faith in God. This point is included to counteract the faith commitment to technicism that is all too often evident in modern technology. Faith in God can have the result of bringing technology into a dimension that is characterized by love and respect rather than exploitation, greed and domination.

Implications for Society

Monsma and his associates specify some general strategies for implementing some of the changes that have been specified. These strategies are briefly described here in the hope that societal understanding of technology can be influenced.

The first tactic suggested is essentially developing what Monsma calls a "network of concern." (Monsma et al., 1986, pg. 227) This is essentially an attempt to educate a network of persons, primarily "nonexperts who are inspired to join together to reform the technological enterprise." Borrowing from the work of Ivan Illich, which involved the idea that elite groups insist on language and symbol usage that removes the possibility of participation by the public in the institutions involved and the social issues surrounding them, Monsma and his associates suggest that the most effective way to counteract the tendencies of these groups is to communicate the knowledge necessary for cultural revolution in the language of nonexperts. Monsma states that "plain words truthfully and powerfully spoken are vital for the development of this network of concern. This strategy will be reviewed in more detail in the following section dealing with implications for schools and curriculum development.

The other strategy mentioned by Monsma et al. involves reforming the mass media. While this seems to be the more difficult task it is in some ways the more essential in that "it will be difficult to carry out the educational goals discussed above if the mass media constantly undermine them and resist a clearheaded analysis of technology." (Monsma et al., 1986, pg. 233) A more detailed discussion of this plan is beyond the scope of this paper.

Implications for Schools and Curriculum Development

It should be noted that this discussion is cursory in nature. It is outside of the scope of this paper to deal with all of the possible ramifications. Any omissions are due to the tentative nature of the discussion included in this paper.

In reality technology is usually confined to a very narrow area of school practice. This is commonly due to the restricted definitions held by those involved. The Curriculum Guides mentioned previously tend to look at technology as a body of knowledge with some references to technology as a cultural activity. Primarily then, technology is viewed through the epistemological and anthropological approaches. Very seldom is technology in schools viewed in the way that Monsma and his colleagues deem to be appropriate. If students are to be taught to value technology in a holistic way then teachers and others who interact in the school environment also need to adopt a broader view of what technology is and what are the responsibilities of those who are involved with technology. If technology is to be used in schools, then it must be used in such a way as to show the environment proper respect as well as increasing the "opportunities for all people to be ... loving, joyful beings." (Monsma et al., 1986, pg. 72)

In curriculum development, technology must be addressed as more than products or processes that can be developed to solve a specific problem. Technology studies should be included in all subjects since it impacts all subjects. Indeed even the process(es) of curriculum development should be recognized to be technological in nature. Technology must be included in the curriculum in such a way as to respect the culture for which it is intended. This becomes difficult in multicultural situations but it is a principle that must be addressed. In the framework of Monsma et al., this would entail the development and use of technological objects that remove or ease human problems and "reserves what is wholesome and good in a given culture." (Monsma et al., 1986, pg. 171) This principle requires communal involvement in the setting of the characteristics of the culture. To be

communally involved requires openness and genuine communication among and between all of those involved.

The principle of stewardship in curriculum development needs to be faced in a way that is more realistic than just meeting the fiscal 'bottom line.' Stewardship in curriculum development should involve the use of materials that is "economic ... that is, frugal out of respect for the nature and finiteness of the resources used." (Monsma et al., 1986, pg. 174) while at the same time bringing out the nature of the materials used in such as way that it is enriched. This principle of stewardship also means that pollution of all types is to be avoided and while still allowing recycling and reuse to be viable processes.

Curriculum development as a technology should also meet the principle of delightful harmony in promoting "harmonious relationships." (Monsma et al., 1986, pg. 175) In the same way curriculum development must also seek to be just, caring and trustful not only in the products but also in the process of designing the products. If one of these principles is not satisfied then the rest of the principles are also overturned. These is a coherence that occurs in a technology that addresses each and every one of the principles. Curricula that are designed in such a way will show love and respect for all including not only humans but also the materials that are used.

Conclusion

Monsma et al., while addressing the topic of defining the nature and role of technological development from a definitively religious standpoint, have managed to bring attention to many of the ways in which society has failed to handle technology. The approaches, anthropological, epistemological and sociological, that have traditionally been used to describe technology were shown to be limiting and in some cases dangerous in their focus on specific aspects of technology to the detriment of others. An alternative definition was offered that attempted to correct some of the difficulties found in the original approaches. This definition is much broader than those which came before and it changes the focus from technology being exclusively for humans to technology as a gift for all of nature. This is especially true when the suggested normative principles are used in judging the relative merits of technologies and the design processes involved in creating them. Finally, a call for the revolution of educative practices and society at large has been made in an effort to prevent technology from making slaves of us all. It would be appropriate if society heeded the call.

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